

DOCUMENT-IDENTIFIER: NN9207373

TITLE: Magneto Optic Sensor for Vortices in a Superconductor.

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- Disclosed is a device for detecting a vortex or a bundle of vortices used as a storage bit in a superconducting vortex memory. A vortex storage system in which mobile vortices, the information bits, are moved in a shift register by currents and are read out by passing them under a Josephson junction which serves as a detector is proposed in (*). In this system, the presence or absence of a vortex or a vortex bundle represents binary "1" and "0." With the advent of the high T_c superconductors, the vortex storage system has become more practical both because it can be operated at liquid nitrogen temperature and because some of these compounds have very mobile vortices. This is evidenced by the observation that some high quality films and single crystals have low critical currents at 77~K. This is particularly true of some of the Bi and Tl copper oxide superconductor compositions in thin-film form. Also, because the vortex mobility ($1/\text{viscosity}$) increases as the normal state resistivity decreases, the oxide superconductors are particularly well suited since they tend to have few carriers and, therefore, a high resistivity in the normal state. The mobility is inversely proportional to the upper critical field which means that these devices will work best close to T_c where the critical field is low. - One of the difficulties of using these

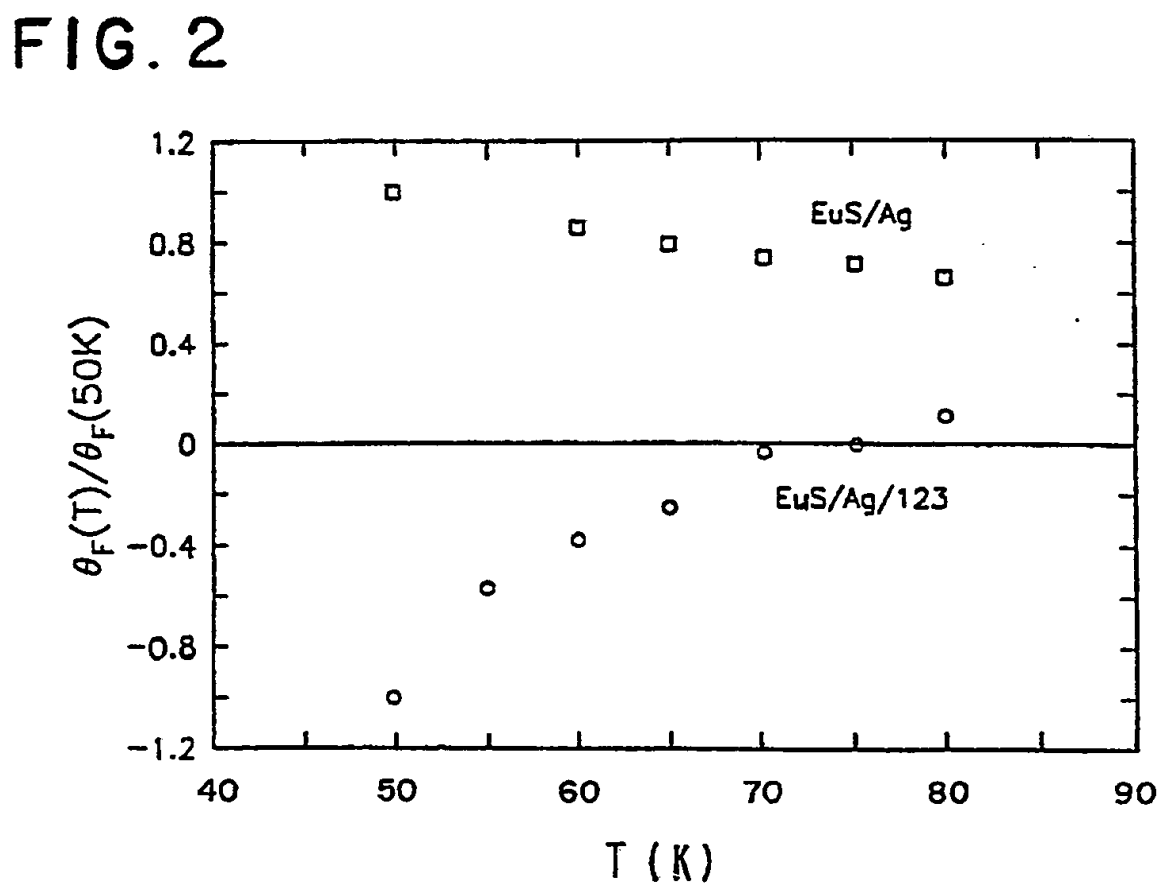
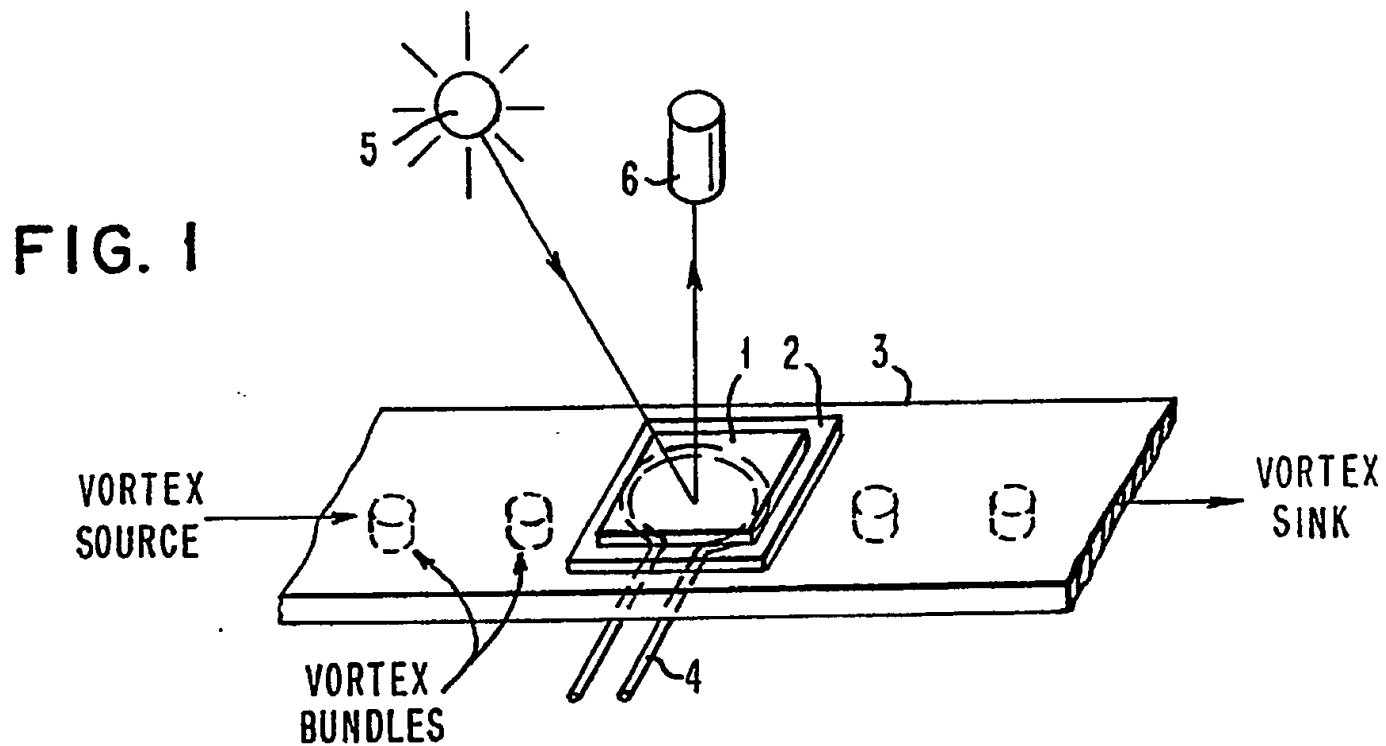
superconductors is that reliable Josephson detectors have not been successfully fabricated. Disclosed is a device for the magneto-optic detection of a vortex bundle eliminating the need for a Josephson junction detector.

The detector, shown in Fig. 1, consists of a thin film of a magneto-optic transducer 1 deposited on a reflector layer 2 which is, in turn, deposited on the superconductor 3. A suitable magneto-optic transducer is a 2500 Å thick film of EuS deposited by electron beam evaporation from an EuS source. A film of this thickness has a Faraday rotation of 20 degrees at a wavelength of 6328 Å in an applied field of 31 kF at a temperature of 20~K. The reflector is a thin layer of silver deposited on a film of YBa₂Cu₃O₇ which has been prepared by laser ablation in a separate evaporator. Other parts of the detector consist of a coil 4 for applying a magnetic field locally to the detector, a source of polarized light 5, a means 6 of detecting the polarization state of the light reflected from the surface and a magnetic field source (not shown) to apply a bias field near the lower critical field H_{c1}. The optical system used in a magneto-optical recording head is suitable for this detector. In operation, the shift register is stepped by one to move a vortex bundle, if present, into the detector region. A current pulse is sent through the coil and, at the same time, the detector region is illuminated with polarized light. If there are no vortices present the superconductor will shield the MO transducer from the field and there will be no change in the rotation of the plane of polarization and the detector will register a "0." If a vortex bundle is present, the magnetic flux will be carried through the cores of the vortices resulting in a local field opposite to that of

the shielding field,
 causing a change in the rotation of the plane of
 polarization. This will
 register as a "1." The signal will be proportional to the
 relative area of
 vortex cores to the total area illuminated. The field
 above the core is
 determined by both the penetration depth and coherence
 length, and is about
 two times as large as H_{c1} at the center of the flux
 vortex. The area
 associated with the core is proportional to the square of
 the coherence length
 ($25 \times 10^{-8} \text{cm}$). The core is in the normal
 (nonsuperconducting state) over this
 area so that the signal will simply depend on the
 fractional area. The ratio
 of core area to total area goes approximately like H/H_{c2}
 where H is the
 applied field and H_{c2} is the upper critical field. For a
 fixed bias field the
 core area will increase with temperature. By using an
 injection laser as a
 light source it should be possible to warm the
 superconductor to a temperature
 closer to T_c during readout so as to make the MO signal
 larger. Also, the
 thickness of the EuS can be adjusted to $1/4$ of the
 wavelength to enhance the
 MO signal by multiple reflections. - The rotation of EuS
 on a silver
 reflector deposited on a thin film of 123 superconductor
 is shown in Fig. 2.
 The temperature dependence is shown for a sample immersed
 in a uniform
 external field and illuminated with 6328 Å laser light.
 Shielding currents at
 the periphery of the film set up a field at the surface of
 the sample equal
 and opposite to the applied field. At the superconducting
 T_c of the sample
 (about 75~K in this case) flux penetrates the film and the
 EuS magneto-optic
 transducer registers a positive field. The other curve in
 the figure is the
 normal temperature dependence of the EuS. Other materials
 with large

magneto-optic rotation would be suitable as a transducer in this application.

- Reference (*) W. Baechtold, "The Vortex File: A New Application of Type-II Superconductivity," IBM Research Report RZ 842, Zurich, Switzerland (June 1977).



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-	277	((vortex or vortices).ti,ab,clm.) and (pin or pinning or pinned).ti,ab,clm.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 11:42
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-	1	4186441.URPN.	USPAT	2003/01/22 12:00
-	2	("3936809" "4082991").PN.	USPAT	2003/01/22 12:00
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	259	(US-5079219-\$ or US-4186441-\$ or US-3999204-\$ or US-3775673-\$ or US-3676718-\$ or US-6023161-\$ or US-5683967-\$ or US-5338943-\$ or US-6269018-\$ or US-6266289-\$ or US-5827170-\$ or US-4869598-\$ or US-4409579-\$ or US-6452764-\$ or US-6368878-\$ or US-6221812-\$ or US-6188920-\$ or US-6104633-\$ or US-5946228-\$ or US-5912210-\$ or US-5798318-\$ or US-5627140-\$ or US-5479059-\$ or US-5378999-\$ or US-5053707-\$ or US-4997809-\$).did. or (US-4921834-\$ or US-4861751-\$ or US-6475223-\$ or US-6445184-\$ or US-6304768-\$ or US-6298259-\$ or US-6272370-\$ or US-6237399-\$ or US-6212419-\$ or US-6211673-\$ or US-6157853-\$ or US-6081402-\$ or US-6015414-\$ or US-6014580-\$ or US-5909119-\$ or US-5619139-\$ or US-5214981-\$ or US-5075280-\$ or US-6479176-\$ or US-6312893-\$ or US-6303242-\$ or US-6207313-\$ or US-6187032-\$ or US-6083885-\$ or US-6054855-\$ or US-6001248-\$ or US-5986453-\$).did. or (US-5981095-\$ or US-5928804-\$ or US-5871625-\$ or US-5817221-\$ or US-5706404-\$ or US-5666467-\$ or US-5491411-\$ or US-5325002-\$ or US-5289150-\$ or US-5093313-\$ or US-5070702-\$ or US-4939976-\$ or US-4802951-\$ or US-4728591-\$ or US-4190817-\$ or US-6317303-\$ or US-6242939-\$ or US-6193194-\$ or US-6078517-\$ or US-5953224-\$ or US-5942765-\$ or US-5903152-\$ or US-5872731-\$ or US-5726873-\$ or US-5656870-\$ or US-5644218-\$ or US-5629889-\$).did. or (US-5625548-\$ or US-5610958-\$ or US-5532664-\$ or US-5532638-\$ or US-5523914-\$ or US-5521570-\$ or US-5519312-\$ or US-5514915-\$ or US-5388068-\$ or US-5377141-\$ or US-5376828-\$ or US-5374914-\$ or US-5359308-\$ or US-5345154-\$ or US-5339062-\$ or US-5323344-\$ or US-5315277-\$ or US-5303111-\$ or US-5260264-\$ or US-5247475-\$ or US-5194803-\$ or US-5181170-\$ or US-5160911-\$ or US-5159261-\$ or US-5146383-\$ or US-5132618-\$ or US-5130687-\$).did. or (US-5115219-\$ or	USPAT; US-PGPUB; EP ; JPO; DERWENT; IBM_TDB	2003/01/22 12:41
Search History	1/26/03 4:50:27 AM Page 52	US-5051791-\$ or US-5041880-\$ or US-5039856-\$ or US-4982571-\$ or US-4962354-\$ or US-4940983-\$ or		

	10	<p>(((US-5079219-\$ or US-4186441-\$ or US-3999204-\$ or US-3775673-\$ or US-3676718-\$ or US-6023161-\$ or US-5683967-\$ or US-5338943-\$ or US-6269018-\$ or US-6266289-\$ or US-5827170-\$ or US-4869598-\$ or US-4409579-\$ or US-6452764-\$ or US-6368878-\$ or US-6221812-\$ or US-6188920-\$ or US-6104633-\$ or US-5946228-\$ or US-5912210-\$ or US-5798318-\$ or US-5627140-\$ or US-5479059-\$ or US-5378999-\$ or US-5053707-\$ or US-4997809-\$).did. or (US-4921834-\$ or US-4861751-\$ or US-6475223-\$ or US-6445184-\$ or US-6304768-\$ or US-6298259-\$ or US-6272370-\$ or US-6237399-\$ or US-6212419-\$ or US-6211673-\$ or US-6157853-\$ or US-6081402-\$ or US-6015414-\$ or US-6014580-\$ or US-5909119-\$ or US-5619139-\$ or US-5214981-\$ or US-5075280-\$ or US-6479176-\$ or US-6312893-\$ or US-6303242-\$ or US-6207313-\$ or US-6187032-\$ or US-6083885-\$ or US-6054855-\$ or US-6001248-\$ or US-5986453-\$).did. or (US-5981095-\$ or US-5928804-\$ or US-5871625-\$ or US-5817221-\$ or US-5706404-\$ or US-5666467-\$ or US-5491411-\$ or US-5325002-\$ or US-5289150-\$ or US-5093313-\$ or US-5070702-\$ or US-4939976-\$ or US-4802951-\$ or US-4728591-\$ or US-4190817-\$ or US-6317303-\$ or US-6242939-\$ or US-6193194-\$ or US-6078517-\$ or US-5953224-\$ or US-5942765-\$ or US-5903152-\$ or US-5872731-\$ or US-5726873-\$ or US-5656870-\$ or US-5644218-\$ or US-5629889-\$).did. or (US-5625548-\$ or US-5610958-\$ or US-5532664-\$ or US-5532638-\$ or US-5523914-\$ or US-5521570-\$ or US-5519312-\$ or US-5514915-\$ or US-5388068-\$ or US-5377141-\$ or US-5376828-\$ or US-5374914-\$ or US-5359308-\$ or US-5345154-\$ or US-5339062-\$ or US-5323344-\$ or US-5315277-\$ or US-5303111-\$ or US-5260264-\$ or US-5247475-\$ or US-5194803-\$ or US-5181170-\$ or US-5160911-\$ or US-5159261-\$ or US-5146383-\$ or US-5132618-\$ or US-5130687-\$).did. or (US-5115219-\$ or</p>	<p>USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB</p>	<p>2003/01/22 12:44</p>
Search History	1/26/03 4:50:27 AM Page 30	US-5011880-\$ or US-5009856-\$ or US-4982571-\$ or US-4962354-\$ or US-4940983-\$ or		

	27	<p> ((US-5079219-\$ or US-4186441-\$ or US-3999204-\$ or US-3775673-\$ or US-3676718-\$ or US-6023161-\$ or US-5683967-\$ or US-5338943-\$ or US-6269018-\$ or US-6266289-\$ or US-5827170-\$ or US-4869598-\$ or US-4409579-\$ or US-6452764-\$ or US-6368878-\$ or US-6221812-\$ or US-6188920-\$ or US-6104633-\$ or US-5946228-\$ or US-5912210-\$ or US-5798318-\$ or US-5627140-\$ or US-5479059-\$ or US-5378999-\$ or US-5053707-\$ or US-4997809-\$).did. or (US-4921834-\$ or US-4861751-\$ or US-6475223-\$ or US-6445184-\$ or US-6304768-\$ or US-6298259-\$ or US-6272370-\$ or US-6237399-\$ or US-6212419-\$ or US-6211673-\$ or US-6157853-\$ or US-6081402-\$ or US-6015414-\$ or US-6014580-\$ or US-5909119-\$ or US-5619139-\$ or US-5214981-\$ or US-5075280-\$ or US-6479176-\$ or US-6312893-\$ or US-6303242-\$ or US-6207313-\$ or US-6187032-\$ or US-6083885-\$ or US-6054855-\$ or US-6001248-\$ or US-5986453-\$).did. or (US-5981095-\$ or US-5928804-\$ or US-5871625-\$ or US-5817221-\$ or US-5706404-\$ or US-5666467-\$ or US-5491411-\$ or US-5325002-\$ or US-5289150-\$ or US-5093313-\$ or US-5070702-\$ or US-4939976-\$ or US-4802951-\$ or US-4728591-\$ or US-4190817-\$ or US-6317303-\$ or US-6242939-\$ or US-6193194-\$ or US-6078517-\$ or US-5953224-\$ or US-5942765-\$ or US-5903152-\$ or US-5872731-\$ or US-5726873-\$ or US-5656870-\$ or US-5644218-\$ or US-5629889-\$).did. or (US-5625548-\$ or US-5610958-\$ or US-5532664-\$ or US-5532638-\$ or US-5523914-\$ or US-5521570-\$ or US-5519312-\$ or US-5514915-\$ or US-5388068-\$ or US-5377141-\$ or US-5376828-\$ or US-5374914-\$ or US-5359308-\$ or US-5345154-\$ or US-5339062-\$ or US-5323344-\$ or US-5315277-\$ or US-5303111-\$ or US-5260264-\$ or US-5247475-\$ or US-5194803-\$ or US-5181170-\$ or US-5160911-\$ or US-5159261-\$ or US-5146383-\$ or US-5132618-\$ or US-5130687-\$).did. or (US-5115219-\$ or US-5051791-\$ or US-5041880-\$ or US-5032986-\$ or US-4982571-\$ or US-4962354-\$ or US-4940983-\$ or </p>	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 12:45
Search History	1/26/03	US-5051791-\$ or US-5041880-\$ or US-5032986-\$ or US-4982571-\$ or US-4962354-\$ or US-4940983-\$ or		

-	85	(vortex or vortices).clm. and (pin or pinning or pinned).clm.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 12:47
-	3	((vortex or vortices).clm. and (pin or pinning or pinned).clm.) and (superconducting or superconductor)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 12:48
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-	737	((superconducting or superconductor) near5 (store or storing or stored or storage or memory or ram)).ab.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 13:26
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-	11	((superconducting or superconductor) near5 (store or storing or stored or storage or memory or ram)).ab.) and (pin or pinning or pinned) and flux	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 13:30

-	9	(((superconducting or superconductor near5 (store or storing or stored or storage or memory or ram)).ab.) and (pin or pinning or pinned) and flux) and (magnetic near field)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 13:31
-	3	((((superconducting or superconductor near5 (store or storing or stored or storage or memory or ram)).ab.) and (pin or pinning or pinned) and flux) and (magnetic near field)) and (vertex or vortices or vortex or vortical or vortexes)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 13:32
-	4	4764898.URPN.	USPAT	2003/01/22 13:32
-	33658	(vortex or vertex or vortexes or vortices or vortical).ab.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 13:33
-	4476	((vortex or vertex or vortexes or vortices or vortical).ab.) and (vortex or vertex or vortexes or vortices or vortical).clm.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 13:34
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-	13	((((vortex or vertex or vortexes or vortices or vortical).ab.) and (vortex or vertex or vortexes or vortices or vortical).clm.) and (magnetic or magnetically or magnetical).clm.) and (store or storing or stored or storage or memory or ram).clm.) and (store or storing or stored or storage or memory or ram).ab.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 13:36
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-	1	4186441.URPN.	USPAT	2003/01/22 13:37

-	2	5079219.URPN.	USPAT	2003/01/22 13:38
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	273	(US-5079219-\$ or US-4186441-\$ or US-3999204-\$ or US-3775673-\$ or US-3676718-\$ or US-6023161-\$ or US-5683967-\$ or US-5338943-\$ or US-6269018-\$ or US-6266289-\$ or US-5827170-\$ or US-4869598-\$ or US-4409579-\$ or US-6452764-\$ or US-6368878-\$ or US-6221812-\$ or US-6188920-\$ or US-6104633-\$ or US-5946228-\$ or US-5912210-\$ or US-5798318-\$ or US-5627140-\$ or US-5479059-\$ or US-5378999-\$ or US-5053707-\$ or US-4997809-\$).did. or (US-4921834-\$ or US-4861751-\$ or US-6475223-\$ or US-6445184-\$ or US-6304768-\$ or US-6298259-\$ or US-6272370-\$ or US-6237399-\$ or US-6212419-\$ or US-6211673-\$ or US-6157853-\$ or US-6081402-\$ or US-6015414-\$ or US-6014580-\$ or US-5909119-\$ or US-5619139-\$ or US-5214981-\$ or US-5075280-\$ or US-6479176-\$ or US-6312893-\$ or US-6303242-\$ or US-6207313-\$ or US-6187032-\$ or US-6083885-\$ or US-6054855-\$ or US-6001248-\$ or US-5986453-\$).did. or (US-5981095-\$ or US-5928804-\$ or US-5871625-\$ or US-5817221-\$ or US-5706404-\$ or US-5666467-\$ or US-5491411-\$ or US-5325002-\$ or US-5289150-\$ or US-5093313-\$ or US-5070702-\$ or US-4939976-\$ or US-4802951-\$ or US-4728591-\$ or US-4190817-\$ or US-6317303-\$ or US-6242939-\$ or US-6193194-\$ or US-6078517-\$ or US-5953224-\$ or US-5942765-\$ or US-5903152-\$ or US-5872731-\$ or US-5726873-\$ or US-5656870-\$ or US-5644218-\$ or US-5629889-\$).did. or (US-5625548-\$ or US-5610958-\$ or US-5532664-\$ or US-5532638-\$ or US-5523914-\$ or US-5521570-\$ or US-5519312-\$ or US-5514915-\$ or US-5388068-\$ or US-5377141-\$ or US-5376828-\$ or US-5374914-\$ or US-5359308-\$ or US-5345154-\$ or US-5339062-\$ or US-5323344-\$ or US-5315277-\$ or US-5303111-\$ or US-5260264-\$ or US-5247475-\$ or US-5194803-\$ or US-5181170-\$ or US-5160911-\$ or US-5159261-\$ or US-5146383-\$ or US-5132618-\$ or US-5130687-\$).did. or (US-5115219-\$ or	USPAT; US-P PUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 13:39
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Search History	1/26/03 4:50:22 AM	Page 48		
C:\APPS\east\workspace	US-5051791-\$ or US-5041880-\$ or US-5039856-\$ or US-4982571-\$ or US-4962354-\$ or US-4940983-\$ or			

	14	<p>(((US-5079219-\$ or US-4186441-\$ or US-3999204-\$ or US-3775673-\$ or US-3676718-\$ or US-6023161-\$ or US-5683967-\$ or US-5338943-\$ or US-6269018-\$ or US-6266289-\$ or US-5827170-\$ or US-4869598-\$ or US-4409579-\$ or US-6452764-\$ or US-6368878-\$ or US-6221812-\$ or US-6188920-\$ or US-6104633-\$ or US-5946228-\$ or US-5912210-\$ or US-5798318-\$ or US-5627140-\$ or US-5479059-\$ or US-5378999-\$ or US-5053707-\$ or US-4997809-\$).did. or (US-4921834-\$ or US-4861751-\$ or US-6475223-\$ or US-6445184-\$ or US-6304768-\$ or US-6298259-\$ or US-6272370-\$ or US-6237399-\$ or US-6212419-\$ or US-6211673-\$ or US-6157853-\$ or US-6081402-\$ or US-6015414-\$ or US-6014580-\$ or US-5909119-\$ or US-5619139-\$ or US-5214981-\$ or US-5075280-\$ or US-6479176-\$ or US-6312893-\$ or US-6303242-\$ or US-6207313-\$ or US-6187032-\$ or US-6083885-\$ or US-6054855-\$ or US-6001248-\$ or US-5986453-\$).did. or (US-5981095-\$ or US-5928804-\$ or US-5871625-\$ or US-5817221-\$ or US-5706404-\$ or US-5666467-\$ or US-5491411-\$ or US-5325002-\$ or US-5289150-\$ or US-5093313-\$ or US-5070702-\$ or US-4939976-\$ or US-4802951-\$ or US-4728591-\$ or US-4190817-\$ or US-6317303-\$ or US-6242939-\$ or US-6193194-\$ or US-6078517-\$ or US-5953224-\$ or US-5942765-\$ or US-5903152-\$ or US-5872731-\$ or US-5726873-\$ or US-5656870-\$ or US-5644218-\$ or US-5629889-\$).did. or (US-5625548-\$ or US-5610958-\$ or US-5532664-\$ or US-5532638-\$ or US-5523914-\$ or US-5521570-\$ or US-5519312-\$ or US-5514915-\$ or US-5388068-\$ or US-5377141-\$ or US-5376828-\$ or US-5374914-\$ or US-5359308-\$ or US-5345154-\$ or US-5339062-\$ or US-5323344-\$ or US-5315277-\$ or US-5303111-\$ or US-5260264-\$ or US-5247475-\$ or US-5194803-\$ or US-5181170-\$ or US-5160911-\$ or US-5159261-\$ or US-5146383-\$ or US-5132618-\$ or US-5130687-\$).did. or (US-5115219-\$ or</p>	<p>USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB</p>	<p>2003/01/22 13:40</p>
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3	<p>(((US-5079219-\$ or US-4186441-\$ or US-3999204-\$ or US-3775673-\$ or US-3676718-\$ or US-6023161-\$ or US-5683967-\$ or US-5338943-\$ or US-6269018-\$ or US-6266289-\$ or US-5827170-\$ or US-4869598-\$ or US-4409579-\$ or US-6452764-\$ or US-6368878-\$ or US-6221812-\$ or US-6188920-\$ or US-6104633-\$ or US-5946228-\$ or US-5912210-\$ or US-5798318-\$ or US-5627140-\$ or US-5479059-\$ or US-5378999-\$ or US-5053707-\$ or US-4997809-\$).did. or (US-4921834-\$ or US-4861751-\$ or US-6475223-\$ or US-6445184-\$ or US-6304768-\$ or US-6298259-\$ or US-6272370-\$ or US-6237399-\$ or US-6212419-\$ or US-6211673-\$ or US-6157853-\$ or US-6081402-\$ or US-6015414-\$ or US-6014580-\$ or US-5909119-\$ or US-5619139-\$ or US-5214981-\$ or US-5075280-\$ or US-6479176-\$ or US-6312893-\$ or US-6303242-\$ or US-6207313-\$ or US-6187032-\$ or US-6083885-\$ or US-6054855-\$ or US-6001248-\$ or US-5986453-\$).did. or (US-5981095-\$ or US-5928804-\$ or US-5871625-\$ or US-5817221-\$ or US-5706404-\$ or US-5666467-\$ or US-5491411-\$ or US-5325002-\$ or US-5289150-\$ or US-5093313-\$ or US-5070702-\$ or US-4939976-\$ or US-4802951-\$ or US-4728591-\$ or US-4190817-\$ or US-6317303-\$ or US-6242939-\$ or US-6193194-\$ or US-6078517-\$ or US-5953224-\$ or US-5942765-\$ or US-5903152-\$ or US-5872731-\$ or US-5726873-\$ or US-5656870-\$ or US-5644218-\$ or US-5629889-\$).did. or (US-5625548-\$ or US-5610958-\$ or US-5532664-\$ or US-5532638-\$ or US-5523914-\$ or US-5521570-\$ or US-5519312-\$ or US-5514915-\$ or US-5388068-\$ or US-5377141-\$ or US-5376828-\$ or US-5374914-\$ or US-5359308-\$ or US-5345154-\$ or US-5339062-\$ or US-5323344-\$ or US-5315277-\$ or US-5303111-\$ or US-5260264-\$ or US-5247475-\$ or US-5194803-\$ or US-5181170-\$ or US-5160911-\$ or US-5159261-\$ or US-5146383-\$ or US-5132618-\$ or US-5130687-\$).did. or (US-5115219-\$ or US-5052791-\$ or US-5041880-\$ or US-5003885-\$ or US-4982571-\$ or US-4962354-\$ or US-4940983-\$ or</p>	<p>USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB</p>	<p>2003/01/22 13:42</p>
Search History 1/26/03 C:\APPS\least\workspace	<p>US-5052791-\$ or US-5041880-\$ or US-5003885-\$ or US-4982571-\$ or US-4962354-\$ or US-4940983-\$ or</p>		

-	8	((pin or pinning or pinned) same (magnetic or magnetically or magnetical) same (vortex or vortices or vortexes or vertex) same (detect or detecting or detected or detector))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 13:47
-	5	((pin or pinning or pinned) same (magnetic or magnetically or magnetical) same (vortex or vortices or vortexes or vertex) same (detect or detecting or detected or detector))) and flux	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 13:45
-	3	((pin or pinning or pinned) and (magnetic or magnetically or magnetical) and (vortex or vortices or vortexes or vertex) and (detect or detecting or detected or detector) and (dope or doped or doping) and (dipole or dipolar))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 13:48
-	24	((pin or pinning or pinned) and (magnetic or magnetically or magnetical) and (vortex or vortices or vortexes or vertex) and (detect or detecting or detected or detector) and (dipole or dipolar))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 13:50
-	20	((pin or pinning or pinned) and (magnetic or magnetically or magnetical) and (vortex or vortices or vortexes or vertex) and (detect or detecting or detected or detector) and (dipole or dipolar) and (store or storing or stored or storage or memory))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 13:51
-	8	((pin or pinning or pinned) and (magnetic or magnetically or magnetical) and (vortex or vortices or vortexes or vertex) and (detect or detecting or detected or detector) and (dipole or dipolar) and (store or storing or stored or storage or memory) and (superconducting or superconductor))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 13:53
-	7	((pin or pinning or pinned) and (magnetic or magnetically or magnetical) and (vortex or vortices or vortexes or vertex) and (detect or detecting or detected or detector) and (dipole or dipolar) and (store or storing or stored or storage or memory) and (superconducting or superconductor) and (tip or probe))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 13:54
-	0	((pin or pinning or pinned) and (magnetic or magnetically or magnetical) and (vortex or vortices or vortexes or vertex) and (detect or detecting or detected or detector) and (dipole or dipolar) and (store or storing or stored or storage or memory) and (superconducting or superconductor) and (tip or probe))) and (vortex or vertex or vortices or vortexes).ti,ab,clm.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 13:54

-	339	(pin or pinning or pinned) near3 (vertex or vortex or vortices or vortexes)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 13:55
-	50	((pin or pinning or pinned) near3 (vertex or vortex or vortices or vortexes)).clm.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 13:56
-	1	((pin or pinning or pinned) near3 (vertex or vortex or vortices or vortexes)).clm.) and flux.clm.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 13:57
-	3	((pin or pinning or pinned) near3 (vertex or vortex or vortices or vortexes)).clm.) and (store or storing or stored or storage).clm.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 13:59
-	41	(magnetic near (vortex or vortices)).ab.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 14:00
-	47	((magnetic near (vortex or vortices)).ab.) (magnetic near (vortex or vortices)).clm.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 14:00
-	4	((magnetic near (vortex or vortices)).ab.) and (magnetic near (vortex or vortices)).clm.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 14:01
-	9	(superconducting same (vortex or vortices)).ti.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 14:02
-	0	((superconducting or superconductor) same (vortex or vortices)).ti.) and ((superconducting or superconductor) same (vortex or vortices)).ab.) and ((superconducting or superconductor) same (vortex or vortices)).clm.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 14:02
-	10	((superconducting or superconductor) same (vortex or vortices)).ti.) and ((superconducting or superconductor) same (vortex or vortices)).ab.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 14:02

-	15	((superconducting or superconductor) same (vortex or vortices)).ti.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 14:05
-	18	((superconducting or superconductor) same (vortex or vortices)).clm.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 14:06
-	15	((superconducting or superconductor) same (vortex or vortices)).clm.) and (flux)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 14:07
-	7	((superconducting or superconductor) same (vortex or vortices)).clm.) and (flux)) and (anchor or anchoring or anchored or trap or trapping or trapped)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 14:07
-	4	((superconducting or superconductor) same (vortex or vortices)).clm.) and (flux)) and (anchor or anchoring or anchored or trap or trapping or trapped)) and (detect or detecting or detector)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/22 14:07